Brief Report

Telerehabilitation for patients with heart failure

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Abstract: Heart failure is a chronic and progressive condition that is associated with high morbidity and mortality rates. Even though cardiac rehabilitation (CR) has been shown to be beneficial to heart failure patients, only a very small proportion of them will actually be referred and eventually participate. The low participation rate is due in part to accessibility and travel difficulties. Telerehabilitation is a new approach in the rehabilitation field that allows patients to receive a complete rehabilitation program at home in a safe manner and under adequate supervision. We believe that by increasing accessibility to CR, telerehabilitation programs will significantly improve heart failure patients' functional capacity and quality of life. However, it is crucial to provide policy makers with evidence-based data on cardiac telerehabilitation if we want to see its successful implementation in heart failure patients.

Keywords: Telerehabilitation; hearth failure; cardiac rehabilitation (CR)

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Introduction

The Canadian Cardiovascular Society defines heart failure as "a complex syndrome in which abnormal heart function results in, or increases the subsequent risk of, clinical symptoms and signs of low cardiac output and/or pulmonary or systemic congestion" (1). This chronic and progressive disease affects 1% to 2% of the North American population. It is also associated with high morbidity and mortality. The annual mortality rate of heart failure varies from 5% to 50% with respect to age and disease severity (2,3). In Canada, approximately 500,000 people suffer from heart failure, with nearly 50,000 new cases diagnosed every year (4).

Recent international recommendations for the treatment of patients with heart failure include not only medical therapy, but also comprehensive care with diet, physical activity and patient education (5,6). Cardiac rehabilitation (CR) enables this comprehensive management seeing that it involves, in addition to physical training, treatment implementation, therapeutic education and socio-professional and psychological management (7). It has been shown that physical training combined with a comprehensive CR program for patients with heart failure allows (I) the increase in exercise tolerance and functional capacity; (II) the improvement in functional status; (III) the reduction in dyspnea; (IV) the improvement in quality of life and possibly; (V) the improvement in prognosis (8). Eventually, CR encourages patients with heart failure to maintain an active lifestyle that prevents deconditioning. Furthermore, CR increases the patients' sense of control over their disease and helps to better manage their symptoms, which in turn reduce hospital admissions and decrease health care costs (9-13). Although exercise programs have been shown to improve the functional capacity of patients with heart failure, these improvements will be temporary if the patients do not comply with the long-term integration of CR.

Despite the proven benefits of CR, only 34% of CR candidates are directed to CR programs (14-16), and in the end only 20% of these candidates participate (17). The underutilization of CR programs can be explained by many factors, most of which are related to the health system, the service providers, the programs and the patients. Among these factors, two particularly remarkable points include

the insufficient accessibility for certain patients to CR and the patients' physical limitation related to their age and their underlying cardiovascular disease that makes travelling difficult (18).

To address this demand and improve the accessibility of effective management, new strategies on providing services in CR are needed. Telerehabilitation is a new approach in rehabilitation that allows the patients to receive interventions at home without the onsite presence of health care professionals (19). This new method of providing rehabilitation services could be a useful tool to increase the accessibility of CR in both rural and urban areas (20). Telerehabilitation allows people with heart failure to receive the complete CR program at home under adequate and secure supervision. Consequently, it is essential to offer evidence-based data to policy makers on telerehabilitation for a population of patients with heart failure.

Telerehabilitation is defined as a telehealth application that uses telecommunication technologies to offer long distance rehabilitation services (21-23). It offers services that were once scarce or unavailable to the population, improves access to services, facilitates the continuity of care for the vulnerable clientele and saves money and time (22-24). Services offered in telerehabilitation are very diverse. They include tele-follow up, teletraining, teleconsultation, teletreatment, and telemonitoring or telesurveillance (23-25).

Up to now, telerehabilitation interventions in cardio-pulmonary medicine have consisted mainly of monitoring activities that record data through the use of telephonic (26,27) or informatics support (28,29) that facilitate better self-management.

The area of interest of our research group involves going beyond simple monitoring: conducting rehabilitation at home by putting the patients in touch with a rehabilitation center. This teletreatment consists of a remote therapeutic intervention through coaching, physical training and repetition of exercises that aims to improve the patients' fitness. It requires synchronous interaction with health professionals who are capable of modifying and adjusting remote interventions as well as coaching patients.

Planned study

We plan to carry out a controlled pilot study of twenty patients to see if CR in heart failure patients can be delivered at home using our telemedicine platform. In the planned study, we will use videoconferencing to deliver a comprehensive telerehabilitation program which will include all core components as telemonitoring, e-learning and telecoaching.

The study seeks to examine the feasibility, acceptability and reliability of using telerehabilitation in heart failure patients. Secondarily, we will also assess the efficacy of the intervention based on the different core components of CR, the safety based on intervention-related adverse events, and the costs associated with telerehabilitation.

Patients will be randomised in two equal groups (telerehabilitation and conventional CR) and observed for a period of six months. All twenty patients will have a Cardiologist assessment and quality of life measurement at the beginning and end of the study. We plan to begin this study by spring 2015. The data from this pilot study will help us plan for a large non-inferiority randomized trial.

Methods

The telerehabilitation platform developed by our research group

The originality of our telerehabilitation project for patients with heart failure lies in the fact that the rehabilitation is conducted from an institution toward a residence and involves the unconventional use of videoconferencing adjusted to the level and the type of interactions required. This program requires technical support that is flexible enough to address the needs and the limits of both sites. In this study, we put forward a platform based on the technical infrastructure that we developed and tested in three previous studies (30-32). This infrastructure connects a system of clinical information to the components of videoconferencing (network camera h.264 and microphone) and uses cameras that physicians control from a software environment. This software environment is composed of two interfaces that allow the convenient and optimal use of technologies through a mouse to support telerehabilitation. A nonin wireless pulse oximeter (Bluetooth) is integrated into the platform and registers and displays real-time data on oxygen saturation and heart rate.

Which types of patients with heart failure could benefit from telerehabilitation?

The selection of patients capable of safely receiving rehabilitation services is crucial. Not every patient with heart failure is eligible to such virtual treatments. Our cardiology team plans to implement a pilot study for patients who meet

the following criteria: (I) the patient is diagnosed with heart failure with left ventricular ejection fraction ≤40%; (II) the patient has a NYHA functional class ≥2/4; (III) the patient is stable for a period of four weeks prior to the beginning of the study (no change in medication or symptoms); (IV) the patient is deemed capable of doing exercises by a doctor. The exclusion criteria include unstable cardiac condition, oxygen dependence and rheumatic, neuromuscular or joint disease that prevents the use of a stationary bike.

Data collection and analysis

Evaluations will take place at baseline (T1), 12 weeks (T2) and 6 months (T3) after the end of the rehabilitation program. At each evaluation, blood pressure, anthropometric measurements, lipid profiles, activity levels, dietary intake and behaviours will be assessed. Results between the conventional and the telerehabilitation groups will be compared to demonstrate the usefulness of telerehabilitation for the delivery of CR in heart failure patients for risk factor modification, functional capacity improvement and patient satisfaction. Descriptive statistics and chi square analysis will be used to analyze the data.

Exercise program and supervision

Our CR program consists of an education and exercise program tutored by a virtual physiotherapist. The complete program includes warm-up, stretching, endurance training, strength training of the limbs, a teaching period on exercises designed for patients with heart failure and a question period. The gradual increase in exercise duration and the gradation of performances promote better exercise tolerance and consequently better compliance. Endurance training will be prescribed based on a "rectangular" type protocol with a heart rate during physical exertion at 50-70% of the heart rate reserve. In addition, isotonic resistance training and segmental specific strengthening exercises improve muscular strength.

Exercise sessions will be held 3 times per week in a 12-week program. In the first 2 weeks, the patients will carry out three completely supervised exercise sessions every week. In the following 5 weeks, they will carry out two exercise sessions under supervision and one without supervision. In the 5 final weeks of the training program, the patients will carry out one exercise session under supervision and two sessions without supervision. This gradual decrease in the frequency of supervised interventions aims to develop the patients' motivation to work out on their own. A cardiologist will be responsible for patient supervision, which includes the clinical surveillance of heart rate and blood pressure and the surveillance of cardiac rhythm via telemetry.

Our experience so far

The team of the Research Chair in Telerehabilitation has already conducted multiple studies on different populations. Certain studies have already been published (30-40). Our experience in the past decade guarantees proven technological reliability. This study will help us optimize our platform to guarantee a successful use in heart failure patients.

Conclusions

The technological advances and the diminished cost over the past few years now allow us to test different innovative models of rehabilitation services. Despite having virtual interactions with patients, increasing the service access for patients who otherwise could not present themselves to the service centers, is more than acceptable.

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